Base Realignment and Closure
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~~DRAFT~~FINAL

TECHNICAL MEMORANDUM TO SUPPORT ~~THE UNRESTRICTED RADIOLOGICAL RELEASE OF~~NO FURTHER ACTION FOR BUILDING 205, INCLUDING THE SUCCTION CHANNELS AND DISCHARGE PIPING

~~March~~ May ~~2016~~2017

PARCEL C PHASE III
RADIOLOGICAL REMEDIATION AND SUPPORT
HUNTERS POINT NAVAL SHIPYARD
SAN FRANCISCO, CALIFORNIA

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ABBREVIATIONS AND ACRONYMS

cm^2	square centimeter
Cs-137	cesium-137
DON	Department of the Navy
dpm	disintegrations per minute
DRG	drawing
HAER	Historic American Engineering Record
HPNS	Hunters Point Naval Shipyard
HRA	Historical Radiological Assessment
LLRW	low level radioactive waste
mrem/y	millirem per year
pCi/g	picocurie per gram
pCi/L	picocurie per liter
Pu-239	plutonium-239
Ra-226	radium-226
RESRAD	residual radioactivity
ROC	radionuclide of concern
SAM	Surveillance and Measurement
Sr-90	strontium-90

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1.0 INTRODUCTION

The Department of the Navy (DON) has prepared this Technical Memorandum to summarize the characterization activities performed to support ~~the unrestricted radiological~~ "No Further Action" ~~release of~~ for Building 205, including the associated collector channel, suction channels, and discharge channel. Building 205 is located in Parcel C within Hunters Point Naval Shipyard (HPNS), San Francisco, California (Figures 1-1 and 1-2). Parcel C is situated adjacent to San Francisco Bay, and Building 205 is located between two drydocks, Drydock 2 and Drydock 3.

Building 205 contains pumping equipment that was used to dewater Drydock 2 and the former Drydock 1[1], and was used as the backup to dewater Drydock 3 in the event Building 140 was inoperable and could not be used to dewater Drydock 3 (U.S. Department of Interior Historic American Engineering Record [HAER] No. CA-2273-C [DOI 2009a], HAER No. CA-2773-F [DOI 2009b]). The building is currently unoccupied, and the pumping equipment within it is inoperable and in a state of disrepair. In its current condition, Building 205 and the associated equipment are incapable of dewatering Drydock 2 (and Drydock 3).

Volume II of the Historical Radiological Assessment (HRA) (NAVSEA 2004) for HPNS identifies Building 205 and associated discharge channel as radiologically impacted components of Drydock 2, with the connector channel between the pump pit and Drydock 3 still present. ~~The identified radiological~~Building 205 was identified as being radiologically impacted because of the impacts ~~are~~ associated with the use of the pumps, intake pipes, collector channel, suction channels, and discharge channel, and not the use of radiological materials in the aboveground structure. Drydock 2 and Drydock 3 were historically used to decontaminate ships that participated in atomic weapons testing; the drydocks also were possible locations where radium-bearing devices were removed from ships during maintenance, and former locations of radium-bearing devices. Because of the nature of the dewatering operations associated with Drydock 2, the interior portions of the collector channel, suction channel between Drydock 2 and Building 205, discharge piping, and discharge channel may have become contaminated with decontamination wastes. With the channels still present between Drydock 3 and Building 205 and the Building 204 gate house (see Figure 1-3), the interior portions of these channels may have been contaminated with decontamination wastes from decontamination activities performed within Drydock 3. The radionuclides of concern (ROCs) listed in the HRA for Building 205 and

[1] Drydock 1 subsequently was replaced with Drydock 3, which was constructed in the same location.

Drydock 2 (and Building 140 and Drydock 3) are cesium-137 (Cs-137), radium-226 (Ra-226), plutonium-239 (Pu-239), and strontium-90 (Sr-90).

The objectives of this Technical Memorandum are to:

- Describe and detail the activities and operations associated with Drydock 2
- Present results of the radiological characterization surveys performed at Building 205 and the surrounding area
- Describe the physical characteristics of the Building 205 components and assess the nature of their operations and any possible radiological impact to human receptors
- Evaluate the results of the surveys and assessments in terms of dose and risk to human health using residual radioactivity (RESRAD) software

This Technical Memorandum is organized as follows:

- Section 1.0, Introduction – Provides the background for Buildings 204 and 205 and a summary of dewatering and flooding operations at Drydock 2.
- Section 2.0, Investigations and Surveys – Presents a summary of the results of the investigation and survey activities performed at Building 205 and its components.
- Section 3.0, Evaluation Results – Presents the evaluation of the various investigation and survey results.
- Section 4.0, References – Provides a list of references cited in this Technical Memorandum.
- Attachment 1 – Building 205 Survey Data
- Attachment 2 – Sediment and Water Sample Data
- Attachment 3 – RESRAD Modeling
- Attachment 4 – DON Drawings and Information on Drydocks 1, 2, and 3 and Buildings 204 and 205
- Attachment 5 – Final Task-Specific Plan for the Building 205 Characterization Survey
- Attachment 6 – Field Change Request FCR #2015-CTO0016-002

1.1 BUILDING 205 AND DRYDOCK 2 BACKGROUND

Building 205 is a single-story, L-shaped brick and wood building measuring 211 feet by 61 feet (12,871 square feet) located north of Drydock 2 toward the east end of the drydock (NAVSEA 2004). The collector channel used for dewatering Drydock 2 passes in a straight line north beneath the entire drydock into the underground suction channel, up through the discharge piping, to San Francisco Bay via an underground discharge channel; the pumps and control equipment for this process are housed in Building 205 (Engineering News 1900). The

underground suction channel used for the dewatering of former Drydock 1 (and still connected at the time of the construction of Drydock 3) passes south toward Building 205 and up through the discharge piping to San Francisco Bay via the same underground discharge channel, using the same pumps and control equipment housed in Building 205 (HAER NO. CA 2773, HAER No. CA 2773-B, HAER No. 2773-C, HAER No. CA-2773-F [DOI-], and DON Drawing [DRG.] No. 16020-78 [DON 1986]). The collector channel, two suction channels, and the discharge channel associated with Building 205 are shown on Figure 1-3.

Building 205 is eligible for listing on the National Register of Historic Places. It meets the criteria for exceptional significance (PAR 1998).

Based on existing information concerning the construction and operation of Drydock 2 (see Figure 1-4 notes), Building 205 and the associated channels, pumps, and piping have been divided into six components, shown on Figure 1-4. The components are color coded on the figure as follows:

- Collector Channel (dark blue) – The water in the drydock flows through a series of covered culverts along the side of the drydock and through sand traps to remove particulate matter prior to entering the collector channel (a grating-covered open culvert approximately 80 feet in length located directly beneath the drydock feeding the suction channel). ~~Although t~~The collector channel is an integral part of the Drydock 2 dewatering operations~~, its location beneath the floor of Drydock 2, places this structure in Parcel F, outside the scope of the Building 205 radiological investigation (see Figure 1-2, which shows the Parcel C boundary).~~
- Suction Channel (light purple) – This is the 8-foot-inside-diameter brick channel lined with a waterproof asphaltum coating that extends from 36 to approximately 50 feet below the ground surface, located on the north side of Drydock 2 and connects to the collector channel. This channel extends approximately 69 feet from the north face of Drydock 2 into the pump pit area of Building 205.
- Building 205 (beige) – This is the abovegrade surface building structure that housed ~~the~~ three pumps and associated control panels used to dewater Drydock 2 (and formerly Drydock 1). These pumps provided the power to move the water from the collector channel into the suction channel and forced the water through the discharge piping into the discharge channel heading east of the pump pit below Building 205 out to San Francisco Bay. Each of the three 400-horsepower pumps is associated with one of the three 38-inch discharge pipes used to dewater ~~the drydock~~Drydock 2. The three 40-horsepower pumps were used to keep the drydock free of water during ship maintenance and/or repair activities; the water was discharged through the 8-inch discharge pipe.

- Pump Pit (light blue) – The 8-foot-wide by 58-foot-long and 37-foot-deep rectangular pit is accessed from a staircase extending from the ground floor within the pump house. Entrances of the suction channels into the pump pit from Drydock 2 and Drydock 3 were closed using hydraulic gate valves.
- Discharge Piping (yellow) – Consists of three 38-inch-diameter cast iron pipes that connect the suction channel to the discharge channel. This discharge pipe was used exclusively during dewatering operations. A check valve, which acted as a backflow preventer when there was no discharge from the pipe, consisted of an 8-foot-diameter cast iron hinged disk that was set in the brick work of the discharge tunnel.
- Discharge Channel (orange) – This is the 8-foot-inside-diameter brick channel lined with a waterproof asphaltum coating that receives water from the discharge piping that flows east of Building 205 and discharges into the San Francisco Bay. The discharge channel is currently open to the Bay and under daily tidal influence.

1.2 DRYDOCK 2 OPERATIONS

Drydock 2 is a graving-type drydock that has generally been in its current configuration since the original construction was completed in 1903 (DoD 1988). The DON acquired HPNS from Bethlehem Steel's marine division, and took over operations of Drydock 2 on December 15, 1941 (DON 1954a).

In 1949, 54 feet of the 8-foot-inside-diameter thick brick circular discharge channel closest to the Bay was replaced with a new 8-foot-inside-diameter concrete square discharge channel (DON Drawing No. 16020-104, DON 1949). The discharge channel reconstruction details are shown on Figure 1-5.

In 1952, the entire drydock floor, which was of timber construction, was replaced with a reinforced concrete floor. Also, additional stairways were provided, sections of the deck wall were repaired, and salt water, compressed air, and chemical service lines were provided along the full length on both sides near the bottom of the drydock (NAVSEA 2004, DON 1954a).

Drydock 2 was designed to dewater in 150 minutes. Initially, the 33-inch-diameter, 400-horsepower pumps dewatered the drydock at a rate of 165,000 gallons per minute. As the water level approached the dock floor, one or more of the main pumps would be shut down to prevent loss of pump suction. As the water level continued to recede, it generally became necessary to throttle the discharge of the last operating pump. The 8-inch-diameter, 40-horsepower drainage pumps cleared the dewatering pump suction chamber and drainage system at a flow rate of 3,200 gallons per minute (DoD 1988, 1989).

Flooding of Drydock 2 was completed in 90 minutes through ducts in an entrance closure caisson (DoD 1988). Drydock 2 was designed to hold approximately 20,363,850 gallons, with the collector channel, suction channel, and sump designed to hold approximately an additional 126,596 gallons.

An entrance closure caisson is built like the hull of a ship, with a keel and a stem at both ends. When the caisson is empty it floats, and may be moved to admit a vessel being floated into the dock. The caisson is placed back at the entrance and filled with water sinking into the grooves intended for it and closing the graving-dock. Drydock 2 was flooded through ducts that penetrated the caisson shell through the caisson ballast tank.

Placing ship(s) into Drydock 2 required two flooding and two dewatering operations:

- First, the caisson was set and the drydock was dewatered to allow workers to enter the drydock and place keel blocks in a configuration that supported the vessel's hull during maintenance activities.
- The drydock was then flooded using the ducts in the caisson to control the rate of flooding to minimize Bay sediments from entering the drydock and to avoid displacement of the keel blocks.
- The entrance closure caisson was then removed to allow the ship to enter the drydock. The ship was centered over the keel blocks, the caisson was set, and the drydock was then dewatered, leaving the ship dry and supported on keel blocks.
- Once the ship repairs or maintenance were completed, the ducts in the caisson were used once again to flood the drydock. The caisson was then removed to allow the ship to exit the drydock.

Records indicate that it was common practice to have multiple ships in Drydock 2 undergoing repairs and maintenance at one time. To ensure a safe work environment in the drydock, water infiltration from various sources was managed through a series of floor drains that sloped from the centerline of the drydock to a culvert system running along both sides of the drydock and into the collector channel through sand traps used as filters to remove particulate matter (DoD 1989).

1.3 BUILDING 204

Building 204 is located north of Building 205 and was the gate house for Drydock 1, which was constructed in 1868 (HAER No. CA-2273). The Building 205 pump plant was used to dewater Drydock 1. Building 204 was used for flooding Drydock 1. Underneath this building, on either side of the Drydock 1 caisson, was a U-shaped channel. Upon opening a valve in the channel, water flooded the drydock, allowing the caisson to float out without capsizing. After the

removal of Drydock 1 to allow construction of Drydock 3 in its place (HAER No. CA-2273, DOI 2009c), Building 204 no longer functioned as a gate house. The channel extending from the bay under the building was cut off and the section exiting the gate house toward the drydock was extended to intersect the channel connecting Drydock 3 to Building 205 (see Figure 1-3). Building 204 was transformed into a salt water pump house, equipped with one high-pressure salt water pump to accommodate washing down and testing activities (HAER No. CA-2273). Gate valves were installed within the channel under the building to divert the bay water up and into Building 204 (Naval Drydocks P.W. DRG. No. 112676 [DON n.d.]). When the DON acquired HPNS from Bethlehem Steel's marine division in December 1941, the DON continued to use Building 204 as a salt water pump house for the purpose of fire control (HAER No. CA-2273-B, DOI 2009d).

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2.0 INVESTIGATIONS AND SURVEYS

As stated in Section 1.0, the HRA (NAVSEA 2004) stated that Building 205 was radiologically impacted because of its association with Drydock 2. Drydock 2 (and Drydock 3) were historically used as decontamination facilities for ships that participated in atomic weapons testing, as the possible location of where radium-bearing devices were removed from ships during maintenance, and as the former location of radium-bearing devices. The various decontamination methods used for ships that participated in atomic and nuclear weapons testing included sandblasting of shipboard components and acid washing of desalinization systems.

During dewatering operations, residual decontamination wastes may have been drawn into the collector channel located at the bottom of Drydock 2 and into the suction channel and then forced through the discharge piping using the pumps housed in Building 205, thereby potentially contaminating the discharge channel and subsequently entering the Bay. Because of the construction of the dewatering system from Drydock 2, only the interior portions of the collector channel, suction channel, discharge piping, and discharge channel could possibly have become contaminated with decontamination media. Even though Drydock 3 was connected to the pump plant in Building 205 as a backup to the Building 140 pump plant, Building 205 was only used to dewater Drydocks 1 and 2 (NAVSEA 2004, DON 1954a). However, water from decontamination activities from Drydock 3 may have flowed into the connector channel and up to the gate valve pit in Building 204, and up to the Building 205 pump pit (see Figure 1-3).

The following section provides a summary of the investigation and surveys performed to date for the Building 205 components, the collector channel from Drydock 3 to the Building 205 pump pit, and the channel connecting the collector channel to the Building 204 valve pit. The characterization activities were performed in accordance with the Final Task-Specific Plan for the Building 205 Characterization Survey (TtEC 2015) provided as Attachment 5, and Field Change Request FCR #2015-CTO0016-002, dated November 2015, provided as Attachment 6.

2.1 DRYDOCK 2 DEWATERING SYSTEM

The Drydock 2 dewatering system consists of six main components: the collector channel, suction channel, Building 205, pump pit, discharge piping, and discharge channel. These components are shown on Figure 1-4 and are discussed in Section 1.1.

2.1.1 Building 205

Building 205 is currently unoccupied, with the pumping equipment contained therein inoperable and in a state of disrepair. Building 205, in its current condition, is incapable of dewatering Drydock 2 (and Drydock 3). No previous documented radiological investigation has been completed; the HRA indicated that potential contamination of Building 205 is unlikely. The actions recommended in the HRA regarding Building 205 consisted of a scoping survey of the structure.

An initial inspection of Building 205 was conducted on September 2, 2015. The inspection revealed evidence of vandalism of the various electrical components and control panels. In addition, some general trash and debris were present within the structure.

On November 5, 2015 and January 27, 2016, the 12 utility boxes and permanently mounted electrical cabinets containing dials and gauges were scanned for the presence of Ra-226 using a Ludlum Model 2350-1 data logger paired with a Ludlum Model 44-10 sodium iodide scintillation detector. The scan range was 3,800 to 15,500 counts per minute. Two locations (Survey Nos. HPS-B205-INV-001-003 and HPS-B205-INV-001-008) exceeded the mean plus 3 sigma of the reference area. On November 6, 2015, these locations were further evaluated using a Berkeley Nucleonics Surveillance and Measurement (SAM) Eagle Isotope Identifier, and the results indicated that the surface concentration of Ra-226 exceeded the release criterion of 100 disintegrations per minute (dpm)/100 square centimeter (cm^2) at 288 dpm/100 cm^2 and 197 dpm/100 cm^2, respectively. On January 20, 2016, three ceramic switches from each cabinet were removed and placed within the Radioactive Materials Area within Building 258 until transferred to the DON's ~~in a~~ low-level radioactive waste (LLRW) ~~bin provided by the DON's LLRW~~ transport and disposal contractor, B&B Environmental Safety, Inc, on March 28, 2016. On January 26, 2016, following the removal of the switches, gamma and alpha/beta static measurements were collected confirming that the activity was below the release criteria. The scanning locations are presented on Figure 1 in Attachment 1. The radiation contamination survey forms, SAM data, Radiation Safety Officer's evaluation of the data, photographs documenting that the switches were removed, and a copy of the ~~of the signed bin~~ transfer sheet documenting that the switches were turned over to B&B Environmental Safety, Inc. are also provided in Attachment 1.

2.1.2 Pump Pit, Discharge Piping, and Discharge Channel

Using available historical drawings and based on site reconnaissance activities, the pump pit was accessed through an opening in the floor with a staircase that extends downward to the centrifugal pumps used for dewatering and draining of the drydock. On the ground level in

Building 205, three separate engines, each connected to a pump with a special laid endless rope, were observed. These engines had been used to turn shafts that extended through the floor to the bottom of the pump pit, where the pumps were actually located.

Access beyond roughly 10 feet beneath the surface of the floor via the staircase was no longer available as the pump pit is flooded to this level—the source of the flooding is unknown, but the water level appears to be relatively stable, and unaffected by seasonal or tidal water action.

On November 4, 2015, an underwater video camera attached to a dive light was used to conduct an inspection of the flooded pump pit and discharge channel to identify areas where sediment may have collected. The images from the camera revealed the presence of sediment and various corrosion products within the pump pit and discharge channel.

Bailers were used to collect water samples from the discharge channel (Sample ID 16-WW-02) through a manhole above the channel (see Figure 1 in Attachment 2) and the pump pit (Sample ID 16-WW-03). As the discharge piping discharges the water from the pump pit directly to the underground discharge channel, with no access to the discharge piping, it was not possible to collect water or sediment samples from the discharge piping. The sediment sample from the discharge channel was collected via a spoon attached to polyvinyl chloride tubing. Water and sediment from the pump pit were pumped through a filter to collect the sediment/debris that had accumulated on the bottom of the pump pit. Aqueous samples were collected on November 3, 2015. The sediment sample from the discharge channel (Sample ID 16-SE-01) was collected on November 4, 2015, and the sediment sample from the pump pit (Sample ID 16-SE-03) was collected on November 6, 2015. These samples were submitted to TestAmerica-St. Louis for analysis. The analytical results for the aqueous samples did not reveal any elevated readings beyond those normally expected from samples of similar media. The aqueous sample collected from the discharge channel (Sample ID 16-WW-02) had Ra-226 activity at 0.693 picocuries per liter (pCi/L), which is below the release criteria of 5 pCi/L. Ra-226 activity was less than the sample detection limit and less than the release criteria in the aqueous sample collected from the pump pit (Sample ID 16-WW-03). Cs-137, Pu-239, and Sr-90 activity was also less than the sample detection limit and less than the release criteria of 119 pCi/L, 15 pCi/L, and 8 pCi/L, respectively, in both of the samples. The sediment samples from the discharge channel and pump pit were collected on November 4 and 6, 2015, respectively. The sediment sample from the discharge channel (Sample ID 16-SE-01) had Cs-137 activity present at 0.117 picocuries per gram (pCi/g), just above the release criterion of 0.113 pCi/g. Ra-226 activity was present at 0.509 pCi/g, which is below the release criterion of 1.625 pCi/g. Pu-239 and Sr-90 activity was less than the sample detection limit and below the release criteria of 2.59 pCi/g and 0.331 pCi/g,

respectively. Cs-137, Pu-239, Ra-226, and Sr-90 activity was less than the sample detection limit and below the release criteria in the sediment sample collected from the pump pit (Sample ID 16-SE-03). The sample locations and summarized analytical results are presented on Figure 1 in Attachment 2. The gamma spectroscopy, plutonium, and strontium data are also provided in Attachment 2.

2.1.3 Suction Channel

Because the suction channel is a depth of approximately 36 feet below the water surface and can only be accessed from land on Parcel C by excavating to a depth of approximately 46 feet below ground surface, no direct measurements or media samples from the suction channel have been collected.

2.1.4 Collector Channel

~~No previous investigations of the collector channel have been identified.~~ The entire collector channel is situated in Parcel F beneath Drydock 2 and connects to the suction channel leading to the Building 205 pump pit. Because the ~~and is~~channel is completely submerged under approximately 36 feet of water ~~within Drydock 2~~, no direct measurements or media samples from the collector channel were collected during this characterization survey. ~~Any additional evaluation and investigation of the collector channel within Drydock 2 will be conducted as a component of the ongoing investigation and potential future remediation activities associated with Parcel F~~Impacted areas in

However, sediment in Parcel F, including Drydock 2 (and Drydock 3), was evaluated to determine the nature and extent of radionuclide activity during a two-phase data gap investigation ~~were evaluated in the Radiological Data Gap Investigations~~ between February 2009 and February 2013 ~~(Phase 1, and 2a [Battelle 2013], and 2b [ITSI Gilbane 2013]) and are summarized in the Addendum to the Feasibility Study Report for Parcel F ((~~KCH 2016). The results of the investigation indicated that the sediment in Parcel F does not have levels of Cs-137, Pu-239, Ra-226, Sr-90 (ROCs for Building 205), and Uranium-235 (U-235) in excess of naturally occurring background levels, and thus, the sediment does not pose unacceptable risk to human health or the environment. The radiological data gap investigations included the advancement of over 300 sediment cores (247 Parcel F cores and 18 reference area cores), generating 800 sediment samples that were analyzed for Cs-137, Pu-239, Ra-226, Sr-90, and U-235. The location of the sediment cores collected from Drydock 2 are provided on Figure 2-1. Furthermore, during these investigations, the DON did not recover radioluminescent items such as dials, gauges, and deck markers from Parcel F sediments (KCH 2016).

2.2 BUILDING 204

Even though Drydock 3 was connected to the pumping plant in Building 205 as a backup to the Building 140 pump plant, Building 205 was only used to dewater Drydocks 1 and 2 (DON 1954a). However, water from Drydock 3 may have flowed into the connector channel and up to the gate valve pit in Building 204 and up to the Building 205 pump pit (see Figure 1-3). Currently, there is no access to the connector channel between Drydock 3 and the Building 205 pump house.

2.2.1 Building 204 Valve Pit

To~~To~~ confirm that past decontamination operations performed in Drydock 3 did not impact the interior portion of the connector channels, sediment and water samples were collected from the Building 204 valve pit and analyzed for the Building 205 ROCs as described below. ~~Currently, there is no access to the connector channel between Drydock 3 and the Building 205 pump house.~~

A bailer was used to collect a water sample from the valve pit (see Figure 1 in Attachment 2). A hand auger modified with a scraper attached with pipe clamps was used to collect a sediment sample from the bottom of the valve pit. The aqueous and sediment samples were collected on November 3 and 5, 2015, respectively, and were submitted to TestAmerica-St. Louis for analysis. The analytical results did not indicate any elevated readings beyond those normally expected from samples of similar media. The aqueous sample (Sample ID 16-WW-01) had Ra-226 activity at 0.0719 pCi/L, which is below the release criteria of 5 pCi/L. Cs-137, Pu-239, and Sr-90 activity was less than the sample detection limit and below the release criteria of 119 pCi/L, 15 pCi/L, and 8 pCi/L, respectively. The sediment sample (Sample ID 16-SE-02) had Cs-137 activity present at 0.0783 pCi/g, Pu-239 activity present at 0.0360 pCi/g, and Ra-226 activity present at 0.524 pCi/g. The Cs-137, Pu-239, and Ra-226 activity in the sediment did not exceed the release criteria of 0.113 pCi/g, 2.59 pCi/g, and 1.625 pCi/g, respectively. Sr-90 activity was less than the sample detection limit and below the release criteria of 0.331 pCi/g. The sample locations and summarized analytical results are presented on Figure 1 in Attachment 2. The gamma spectroscopy, plutonium, and strontium data are also provided in Attachment 2.

2.2.2 Drydock 3 Sediment Investigation

As stated in Section 2.1.4, the results of the Parcel F two-phase data gap investigation performed between February 2009 and February 2013 indicated that Parcel F sediment, including Drydock 3 sediment, does not have levels of Cs-137, Pu-239, Ra-226, Sr-90 (ROCs for Building 205), and

U-235 in excess of naturally occurring background levels, and thus, the sediment does not pose unacceptable risk to human health or the environment (KCH 2016). The location of the sediment cores collected from Drydock 3 are provided on Figure 2-1. Furthermore, during these investigations, the DON did not recover radioluminescent items such as dials, gauges, and deck markers from Parcel F sediments (KCH 2016).

3.0 EVALUATION RESULTS

The DON is recommending ~~unrestricted radiological release of~~"No Further Action" for Building 205 (Drydock 2 Pump House)~~ located in Parcel C~~, including its components, the ~~portion of the~~ collector and suction ~~and collector~~ channels~~ located in Parcel C~~, the pump pit, the discharge piping, and the discharge channel. ~~The collector channel is located in Parcel F, and will be~~is ~~addressed as part of the Parcel F response.~~

Based on the results of the gamma scan survey of the utility boxes and permanently mounted electrical cabinets within Building 205, a total of six ceramic switches were removed and disposed of as LLRW. The remaining boxes and cabinets do not have activity above the release criteria.

Due to the inaccessibility of the Drydock 2 collector channel (and Drydock 3 collector channel), the suction channel between Drydock 2 and the Building 205 pump pit, and the suction channel between Drydock 3 and the Building 205 pump pit, no samples were collected from ~~this~~ these areas. However, the wood decking in Drydock 2 (and Drydock 3) was removed and replaced with new reinforced concrete slab flooring in 1952 (DON 1954a,b). Therefore, any residual radiological contamination from ships that participated in atomic weapons testing prior to 1952, which might have lodged in the porous wood structures and been released later during dewatering operations, would have been removed when the flooring was replaced. Furthermore, the results of the Parcel F data gap investigations performed between February 2009 and February 2013 indicate that that the radioactivity in Parcel F sediment, including the sediment at Drydocks 2 and 3, is consistent with background (KCH 2016). Thus, if sediment is present within the collector channels at Drydocks 2 and 3, no further action is required in these areas.

Because the collector channel was designed with sand traps and grating to minimize sedimentation into the suction channel, any residual sediment would tend to be pushed from the collector channel through the suction channel, through the pumps, then through the discharge piping and the discharge channel and into the Bay during the surge flow when dewatering operations were performed. This surge flow occurred when the drydock was dewatered to allow workers to enter the drydock and place keel blocks to support the vessel during maintenance activities. The surge flow occurred again after the drydock had been flooded to allow entrance of the ship into the drydock to leave the ship dry and supported on keel blocks for performance of maintenance activities.

Each dewatering event involved the transfer of over 20 million gallons of water from the drydock through the collector channel, and through the suction channel and discharge piping and into the discharge channel in 2.5 hours. Assuming a minimum of one ship per year required maintenance between 1946 (start of OPERATIONS CROSSROADS) and 1952 (when the wood decking was replaced with a concrete floor), a total of 240 million gallons of water would have been transferred from the drydock through the collector channel, suction channel, and discharge piping and into the discharge channel. Assuming one ship per year required maintenance between 1953 and 1974 (when the DON closed HPNS), a total of 880 million gallons of water would have been transferred from the drydock through the collector channel, suction channel, and discharge piping and into the discharge channel.

No Cs-137, Pu-239, Ra-226, and Sr-90 activity was detected above the release criteria in both the aqueous and sediment samples collected from the Building 205 pump pit.

Because of the inaccessibility of the ~~collector~~ suction channel between Drydock 3 and the Building 205 pump pit, aqueous and sediment samples were instead collected from the Building 204 valve pit, which connects Building 204 to this ~~collector~~ suction channel. No Cs-137, Pu-239, Ra-226, and Sr-90 activity was detected above the release criteria in the aqueous and sediment samples collected from the Building 204 valve pit. Any potential future human exposure to potentially impacted ~~collector~~ suction channel piping and sediment is very unlikely due to the inaccessibility of the suction channel, which is located at least 36 feet below the existing ground surface.

It is unlikely that the non-porous cast iron discharge piping and the interior surface of the asphaltum-lined brick channel of the suction channel between the Drydock 2 collector channel and the Building 205 pump pit would have been radiologically impacted because any materials from ship decontamination efforts would have been transported rapidly during dewatering operations and deposited in the discharge channel, which is the most likely accumulation point for sediment. Any potential future human exposure to potentially impacted suction channel piping and sediment (if present at all) is very unlikely due to the inaccessibility of the suction channel. The aqueous and sediment samples from the Building 205 discharge channel were collected from within a portion of the original asphaltum-lined brick channel. No Cs-137, Pu-239, Ra-226, and Sr-90 activity was detected above the release criteria in the aqueous sample. The sediment sample had Cs-137 activity present at 0.117 pCi/g. Pu-239, Ra-226, and Sr-90 activity did not exceed the release criteria. The global background soil Cs-137 activity concentrations range from 0.3 to 3.0 pCi/g (Wallo et al. 1994). Additionally, mean concentrations of Cs-137 in drainage areas are typically three times that of non-drainage areas

(Wallo et al. 1994). Thus, the activity concentration of 0.117 pCi/g may be attributed to global background soil Cs-137 activity concentrations, rather than being associated with decontamination efforts from ships that participated in atomic weapons testing.

The radiological remediation industry standard for determining both annual dose and risk is the RESRAD family of codes developed by Argonne National Laboratory (C. Yu et. al. 2001). This software allows for input of numerous site-specific parameters to develop annual dose and/or risk outputs based on exposure pathways, including external gamma, inhalation, plant ingestion, meat ingestion, milk ingestion, aquatic foods, drinking water, soil ingestion, and radon. Default parameters are automatically provided, but appropriate site-specific values may be input to best utilize the strength of the software for site-specific applications. If the maximum concentration of 0.117 pCi/g from the sample in the discharge channel is modeled using all default parameters, and the discharge channel is assumed to be completely filled with soil/sediment at that activity concentration (worst case at 247 feet long and 8 feet wide for maximum area of 184 square meters), the RESRAD model results in a maximum annual dose of 0.200 millirem per year (mrem/y) and a risk of 3.266×10^{-6} to an adult resident living in direct contact with the soil/sediment. These values are sufficiently less than the U.S. Environmental Protection Agency risk release limit for radiological concerns of 3×10^{-4} (nominally 12 mrem/y) identified in the Office of Solid Waste and Emergency Response (OSWER) directive 9200.4-18, Establishment of Clean Up Levels for CERCLA Sites with Radioactive Contamination (EPA 1997) and OSWER directive 9285.6-20, Distribution of the Radiation Risk Assessment at CERCLA Sites: Q&A. June 13 (EPA 2014). The RESRAD data are provided in Attachment 3.

It is unlikely that the interior surface of the first 193 feet of the brick discharge channel would have been radiologically impacted due to the placement of the asphaltum waterproof lining. Similar to the cast iron discharge piping and the asphaltum-lined brick channel of the suction channel, it is also unlikely that this portion of the brick discharge channel would have been radiologically impacted because any materials from ship decontamination efforts would have been transported rapidly during dewatering operations.

With the 54 feet of the discharge channel closest to the Bay replaced with a new 8-foot-inside-diameter concrete square discharge channel in 1949, any residual radiological contamination from ships that participated in atomic weapons testing, which might have been present in that portion of the discharge channel, would also have been removed.

All but 8 of the 79 target and support ships that had returned to HPNS following OPERATIONS CROSSROADs had been decontaminated by December 1947. Per the HRA, after 1948, no mention of OPERATION CROSSROADS ships, other than the ex-INDEPENDENCE, is found

in available historical records (NAVSEA 2004). With 90 percent of the ships decontaminated by December 1947 and the 54 feet of the discharge channel closest to the Bay replaced with a new concrete channel in 1949, any radiological impacts to the interior portion of the concrete channel would have been negligible.

Based on the investigations, surveys, and data presented herein, Building 205 and its appurtenant structures present no radiological threat to human health and the environment ~~and can be released for unrestricted use~~. The DON is recommending "No Further Action" for Building 205, including the suction channel between Drydock 2 and the Building 205 pump pit, pump pit, discharge piping, and discharge channel along with the Drydock 2 ~~and~~ collector channel, the suction channel between Drydock 3 and the Building 205 pump pit, and the intake channel into Building 204 as shown on Figure 1-3~~The DON is recommending unrestricted radiological release of Building 205, including the suction and collector channels, pump pit, discharge piping, and discharge channel, as the surfaces of these components are free of residual radioactive contamination~~.

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FIGURES

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ATTACHMENT 1

BUILDING 205 SURVEY DATA

~~(Signed Bin Transfer Sheet to be Provided in Final Version)~~

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ATTACHMENT 2

SEDIMENT AND WATER SAMPLE DATA

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ATTACHMENT 3

RESRAD MODELING

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ATTACHMENT 4

DON DRAWINGS AND INFORMATION ON DRYDOCKS 1, 2, AND 3 AND BUILDINGS 204 AND 205

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ATTACHMENT 5

FINAL TASK-SPECIFIC PLAN FOR THE BUILDING 205 CHARACTERIZATION SURVEY

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ATTACHMENT 6

FIELD CHANGE REQUEST FCR #2015-CTO0016-002

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